

Current Organic Chemistry, 11(17): 1491-1524

Recent Development of Functionalized N-heterocyclic Carbene Ligands:
Coordination Chemistry and Catalytic Applications

Lee, Hon Man; Lee, Chun-Chin; Cheng, Pi-Yun

Abstract

N-heterocyclic carbenes are extremely versatile ligands in homogeneous catalysis and coordination chemistry. A concurrent focus in this field is the construction of functionalized N-heterocyclic carbenes containing classical donor groups. The interest stems from the fact that multidentate ligand scaffolds can be finely constructed to fulfill specific purposes, such as providing extra-stability for metal complexes, possessing hemilability for effective generation of vacant coordination site, and allowing fine tuning of electronic and steric effects for inducing chemo-, stereo-, and enantioselectivities in catalytic reactions. There are numerous works on such multidentate ligands reported in the literature, in particular, those containing phosphorus, oxygen, and nitrogen functionalities. In this review, we will summarize the current development on functionalized N-heterocyclic carbenes in combination with classical donors of group 15 and 16 elements, illustrating typical preparations of the ligand precursors and their transition metal complexes. The coordination chemistry as well as catalytic applications of these ligands will be presented.

Key words : Bidentate Ligands; N-Heterocyclic Carbene; Heck coupling reactions; Deprotonation; Pyridine-functionalized NHC ligands